FIG.1

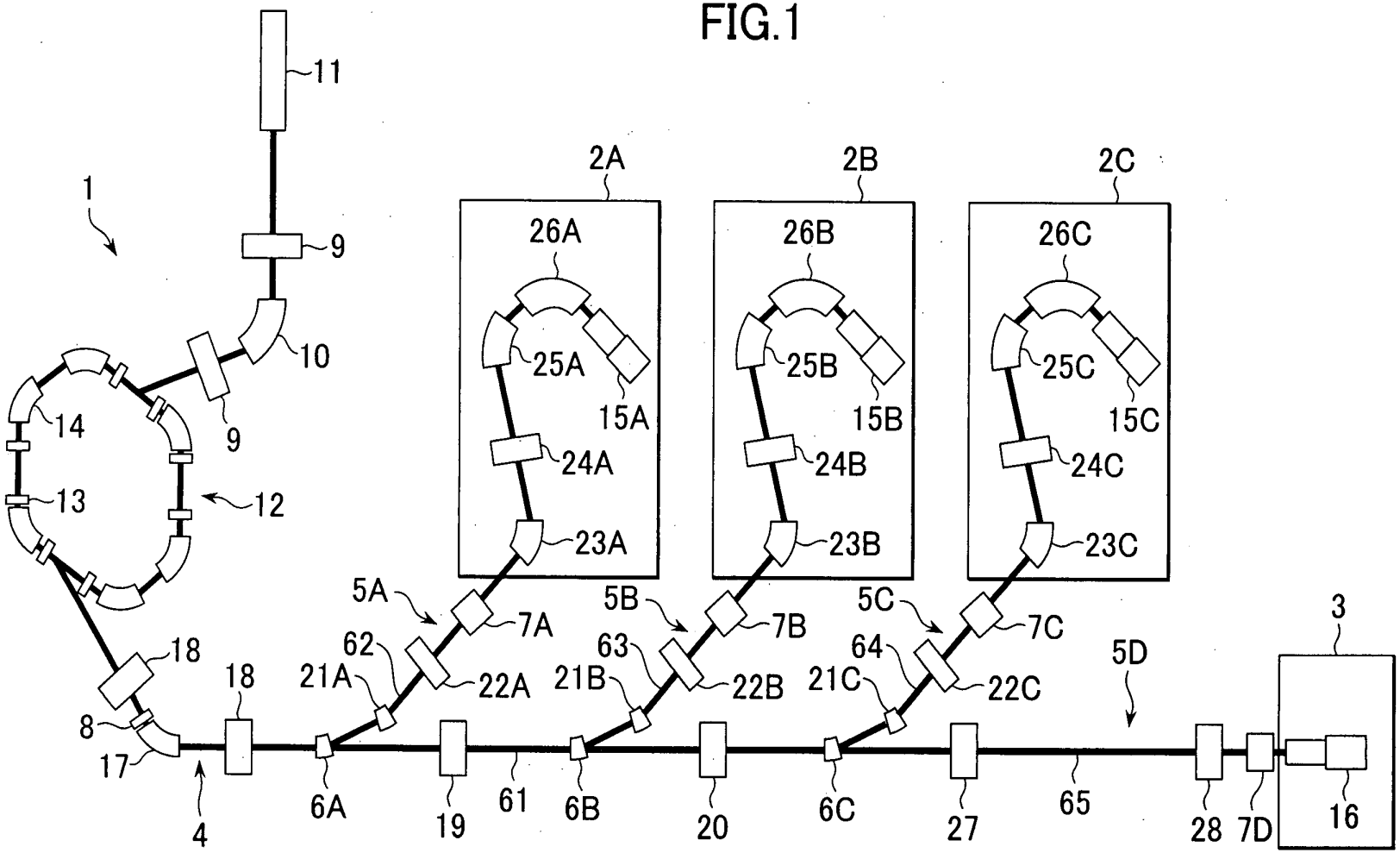

11
1
9
10
14
9
13
12
2A
2B
2C
26A
26B
26C
25A
25B
25C
15A
15B
15C
24A
24B
24C
23A
23B
23C
5A
5B
5C
7A
7B
7C
3
18
62
63
64
5D
18
21A
21B
21C
22A
22B
22C
8
17
4
6A
19
61
6B
20
6C
27
65
28
7D
16

FIG.2

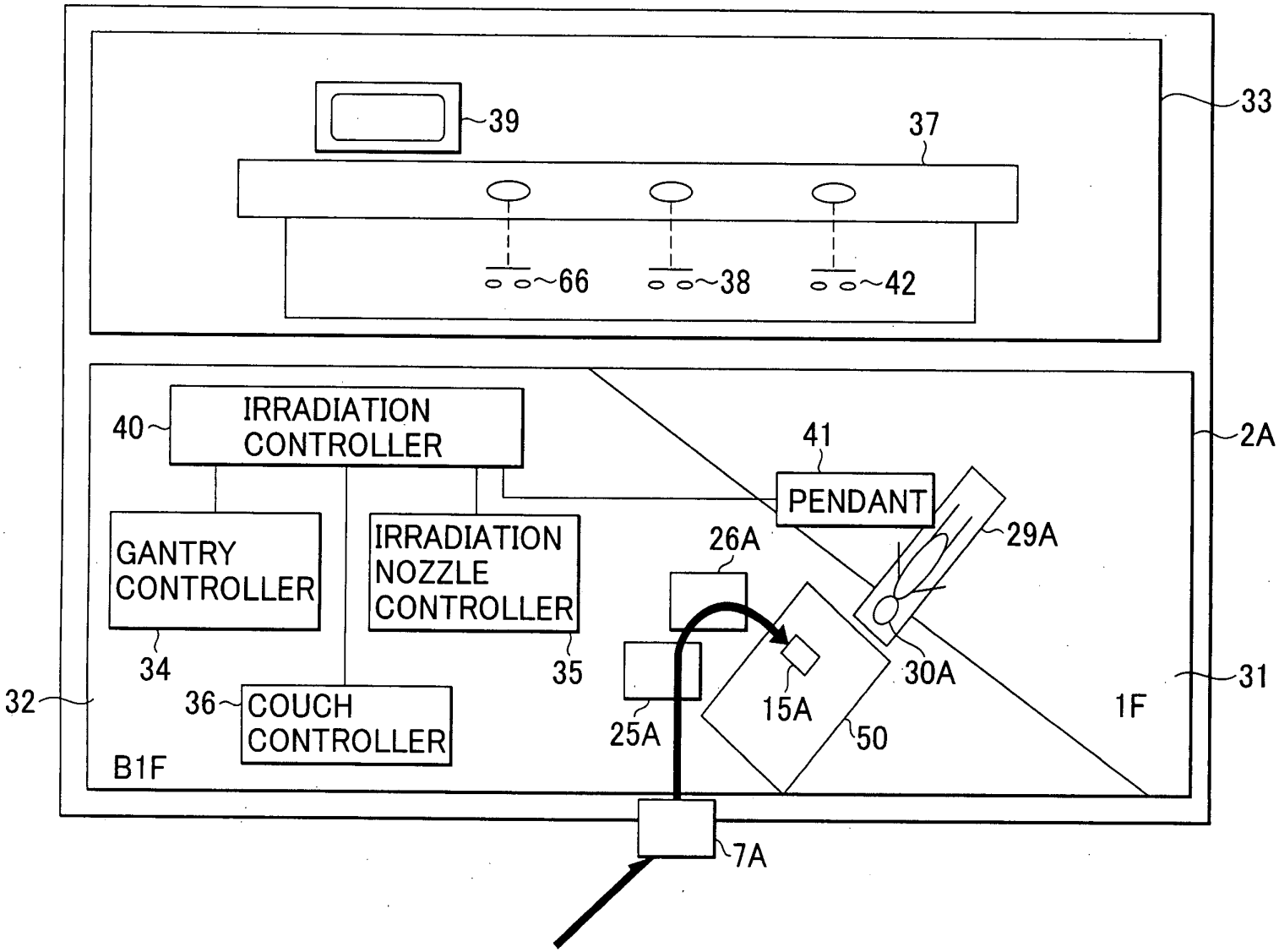

39
37
33
66
38
42
40
IRRADIATION CONTROLLER
41
PENDANT
2A
GANTRY CONTROLLER
IRRADIATION NOZZLE CONTROLLER
26A
29A
34
35
30A
32
36
COUCH CONTROLLER
25A
15A
50
31
1F
B1F
7A

FIG.3

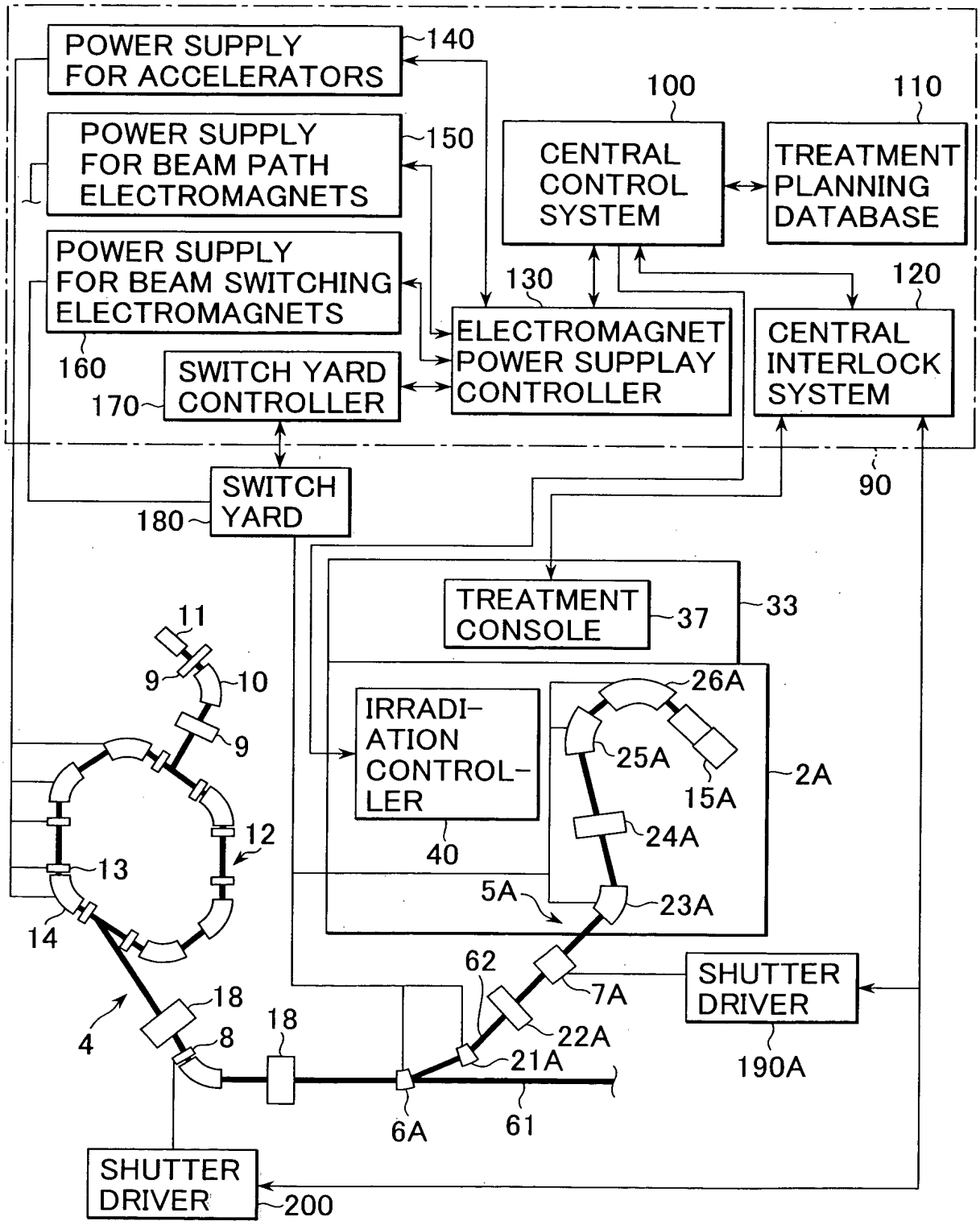
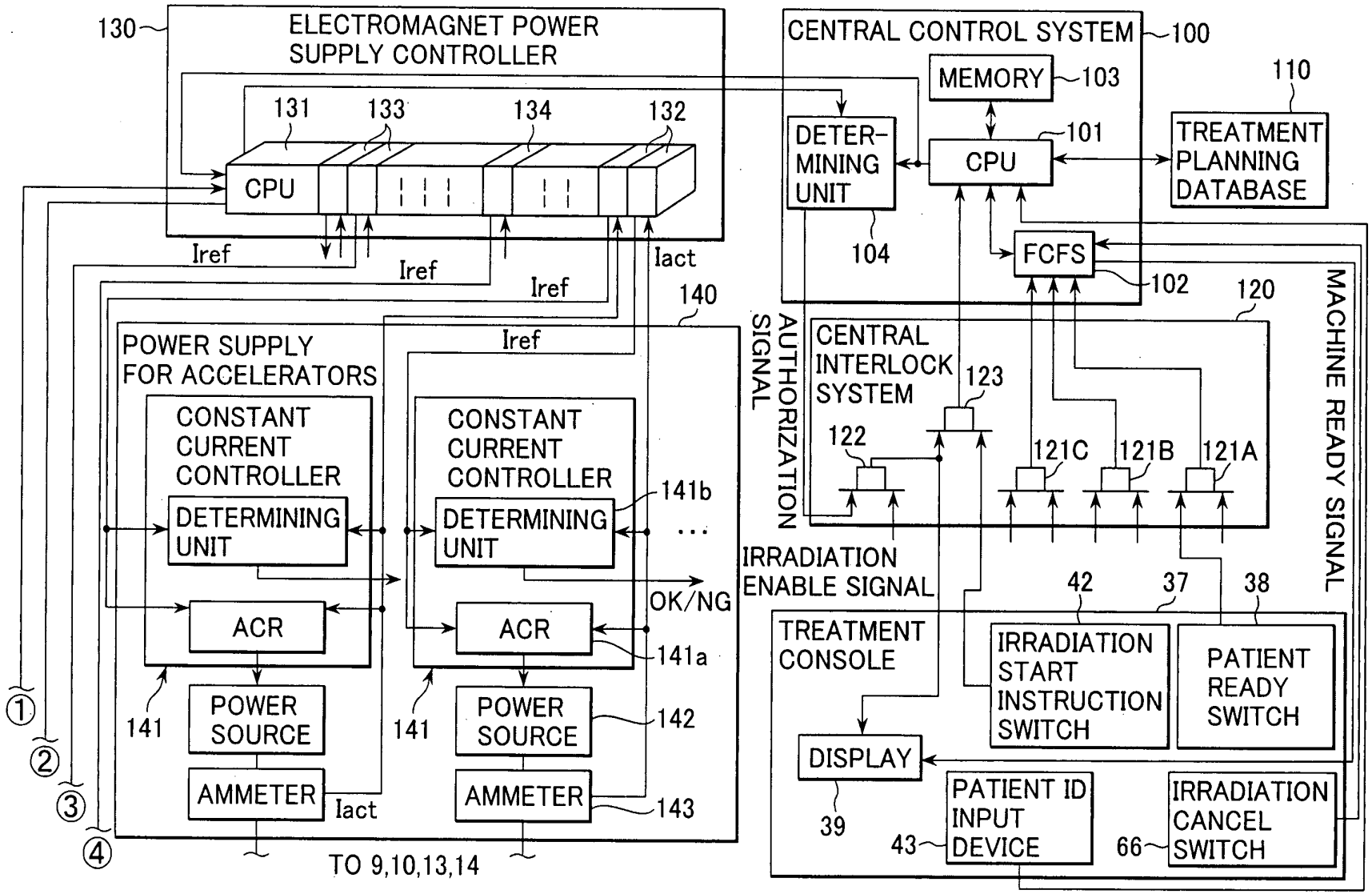

POWER SUPPLY FOR ACCELERATORS
140
100
110
POWER SUPPLY FOR BEAM PATH ELECTROMAGNETS
150
CENTRAL CONTROL SYSTEM
TREATMENT PLANNING DATABASE
POWER SUPPLY FOR BEAM SWITCHING ELECTROMAGNETS
130
120
160
SWITCH YARD CONTROLLER
170
ELECTROMAGNET POWER SUPPLAY CONTROLLER
CENTRAL INTERLOCK SYSTEM
90
SWITCH YARD
180
TREATMENT CONSOLE
37
33
IRRADI-ATION CONTROL-LER
40
26A
25A
15A
2A
24A
5A
23A
11
9
10
9
12
13
14
4
18
8
18
62
7A
22A
21A
6A
61
SHUTTER DRIVER
190A
SHUTTER DRIVER
200

FIG.4


130
ELECTROMAGNET POWER SUPPLY CONTROLLER
131
133
134
132
CPU
Iref
Iref
Iref
Iact
140
POWER SUPPLY FOR ACCELERATORS
CONSTANT CURRENT CONTROLLER
DETERMINING UNIT
ACR
POWER SOURCE
AMMETER
Iact
141
141
141b
142
143
OK/NG
141a
TO 9,10,13,14
①
②
③
④
CENTRAL CONTROL SYSTEM
100
MEMORY
103
110
DETER-MINING UNIT
104
CPU
101
TREATMENT PLANNING DATABASE
FCFS
102
120
CENTRAL INTERLOCK SYSTEM
123
122
121C
121B
121A
AUTHORIZATION SIGNAL
IRRADIATION ENABLE SIGNAL
MACHINE READY SIGNAL
42
37
38
TREATMENT CONSOLE
IRRADIATION START INSTRUCTION SWITCH
PATIENT READY SWITCH
DISPLAY
39
PATIENT ID INPUT DEVICE
43
IRRADIATION CANCEL SWITCH
66

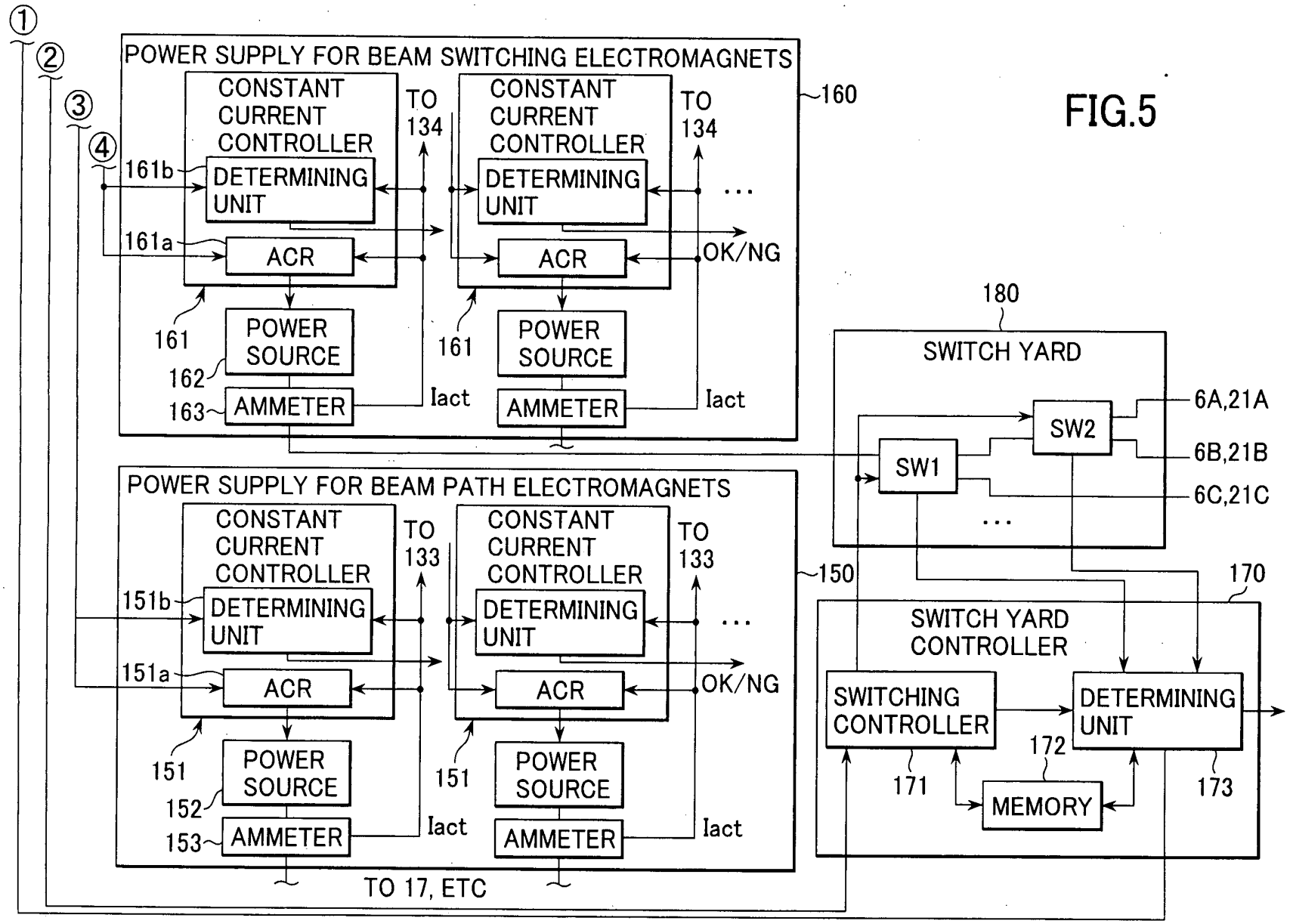

①
②
③
④
POWER SUPPLY FOR BEAM SWITCHING ELECTROMAGNETS
160
CONSTANT CURRENT CONTROLLER
TO 134
161b
DETERMINING UNIT
161a
ACR
OK/NG
161
162
POWER SOURCE
163
AMMETER
Iact
POWER SUPPLY FOR BEAM PATH ELECTROMAGNETS
150
TO 133
151b
151a
151
152
153
TO 17, ETC
180
SWITCH YARD
SW1
SW2
6A,21A
6B,21B
6C,21C
170
SWITCH YARD CONTROLLER
SWITCHING CONTROLLER
171
172
MEMORY
173

FIG.5

FIG.6

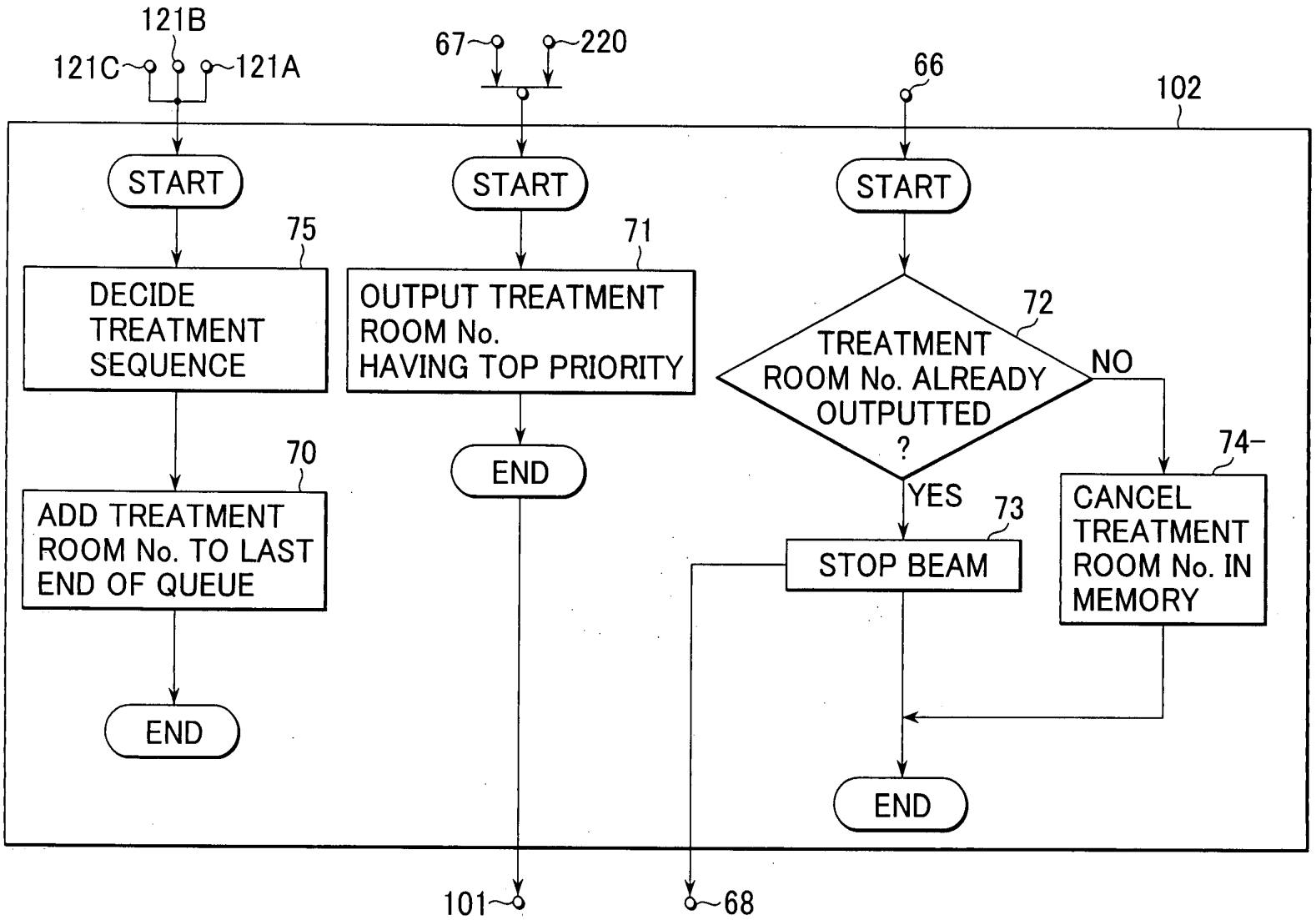

121B
121C
121A
67
220
66
102
START
START
START
75
71
72
DECIDE TREATMENT SEQUENCE
OUTPUT TREATMENT ROOM No. HAVING TOP PRIORITY
TREATMENT ROOM No. ALREADY OUTPUTTED ?
NO
74
70
END
YES
73
CANCEL TREATMENT ROOM No. IN MEMORY
ADD TREATMENT ROOM No. TO LAST END OF QUEUE
STOP BEAM
END
END
101
68

FIG.7

PATIENT DATA

PATIENT ID No.	DOSE	(TREATMENT ROOM No.)	ENERGY	.....
650098	...	(No.1)	70Mev	.....

FIG.8

GB : BENDING ELECTROMAGNET
GQ : QUADRUPOLE ELECTROMAGNET

ENERGY (MeV)	COMMON						
	BEFORE ACCELERATION		SYNCHROTRON			AFTER ACCELERATION	
	GB10	GQ9	GB14	GQ13	GQ13	GB17	GQ18
70	...	...	Pattern 70			...	...
80			Pattern 80			...	...
90			Pattern 90			...	...
⋮			⋮			⋮	⋮
⋮			⋮			⋮	⋮
⋮			⋮			⋮	⋮

ENERGY (MeV)	No.1 TREATMENT ROOM 2A		No.1 to No.2	No.2 TREATMENT ROOM 2B		No.2 to No.3	No.3 TREATMENT ROOM 2C	
	GQ22A	GQ24A	GQ19	GQ22B	GQ24B	GQ20	GQ22C	GQ24C
70	...	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...	...
90	...	...	...	...	...	...	...	...
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

ENERGY (MeV)	No.3 to No.4	No.4 TREAT-MENT ROOM 3	SWITCHING POWER SOURCE 162-1	SWITCHING POWER SOURCE 162-2	SWITCHING POWER SOURCE 162-3	SWITCHING POWER SOURCE 162-4
	GQ27	GQ28				
70	...	...	...	...	...	...
80	...	...	...	...	...	...
90	...	...	...	...	...	...
⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮

FIG.9

GB : BENDING ELECTROMAGNET
GQ : QUADRUPOLE ELECTROMAGNET

TREATMENT ROOM No.	COMMON						
	BEFORE ACCELERATION		SYNCHROTRON			AFTER ACCELERATION	
	GB10	GQ9	GB14	GQ13	GQ13	GB17	GQ18
1	ON						
2							
3							
4							

TREATMENT ROOM No.	No.1 TREATMENT ROOM 2A		No.1 to No.2	No.2 TREATMENT ROOM 2B		No.2 to No.3	No.3 TREATMENT ROOM 2C	
	GQ22A	GQ24A	GQ19	GQ22B	GQ24B	GQ20	GQ22C	GQ24C
1	ON		No Care					
2	No Care		ON	ON		No Care		
3	No Care		ON	No Care		ON	ON	
4	No Care		ON	No Care		ON	No Care	

TREATMENT ROOM No.	No.3 to No.4	No.4 TREATMENT ROOM 3	SWITCHING POWER SOURCE 162-1	SWITCHING POWER SOURCE 162-2	SWITCHING POWER SOURCE 162-3	SWITCHING POWER SOURCE 162-4
	GQ27	GQ28				
1			ON			
2						
3	No Care					
4	ON	ON				

FIG.10

GB : BENDING ELECTROMAGNET
GQ : QUADRUPOLE ELECTROMAGNET

PATIENT ID No.	DOSE	TREAT-MENT ROOM No.	ENERGY
650098	···	No.1	70Mev

COMMON							No.1 TREMENT ROOM 2A	
BEFORE ACCELERATION		SYNCHROTRON			AFTER ACCELERATION			
GB10	GQ9	GB14	GQ13	GQ13	GB17	GQ18	GQ22A	GQ24A
···	···	Pattern 70			···	···	···	···

No.1 to No.2	No.2 TREATMENT ROOM 2B		No.2 to No.3	No.3 TREATMENT ROOM 2C		No.3 to No.4	No.4 TREAMENT ROOM 3
GQ19	GQ22B	GQ24B	GQ20	GQ22C	GQ24C	GQ27	GQ28
No Care	No Care	No Care	No Care	No Care	No Care	No Care	No Care

SWITCHING POWER SOURCE 162-1	SWITCHING POWER SOURCE 162-2	SWITCHING POWER SOURCE 162-3	SWITCHING POWER SOURCE 162-4
···	···	···	···

FIG.11

GB : BENDING ELECTROMAGNET

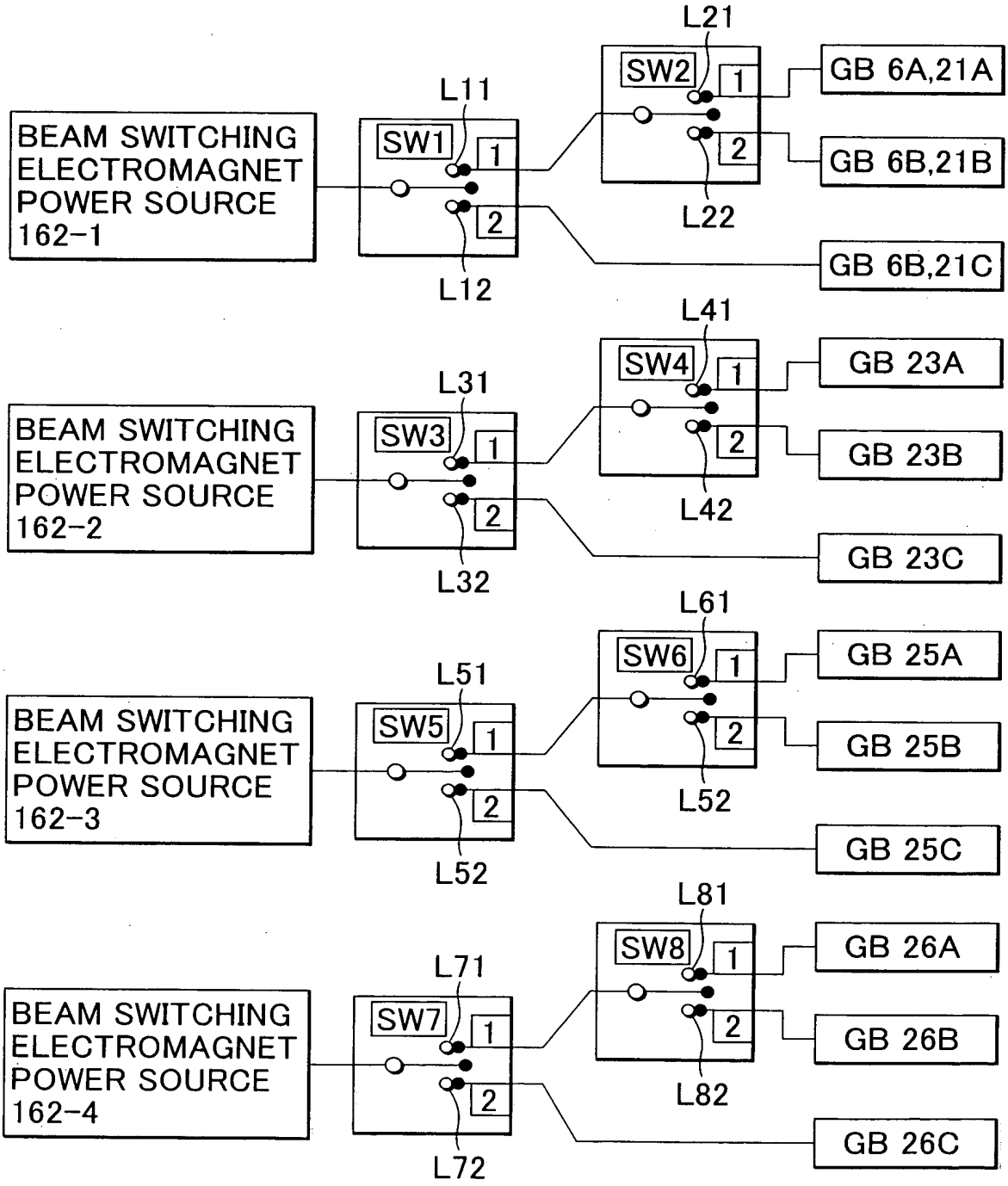


FIG.12

TREATMENT ROOM No.	SWITCH No.							
	1	2	3	4	5	6	7	8
1	1	1	1	1	1	1	1	1
2	1	2	1	2	1	2	1	2
3	2	No Care	2	No Care	2	No Care	2	No Care
4	No Care	No Care	No Care	No Care	No Care	No Care	No Care	No Care

FIG.13

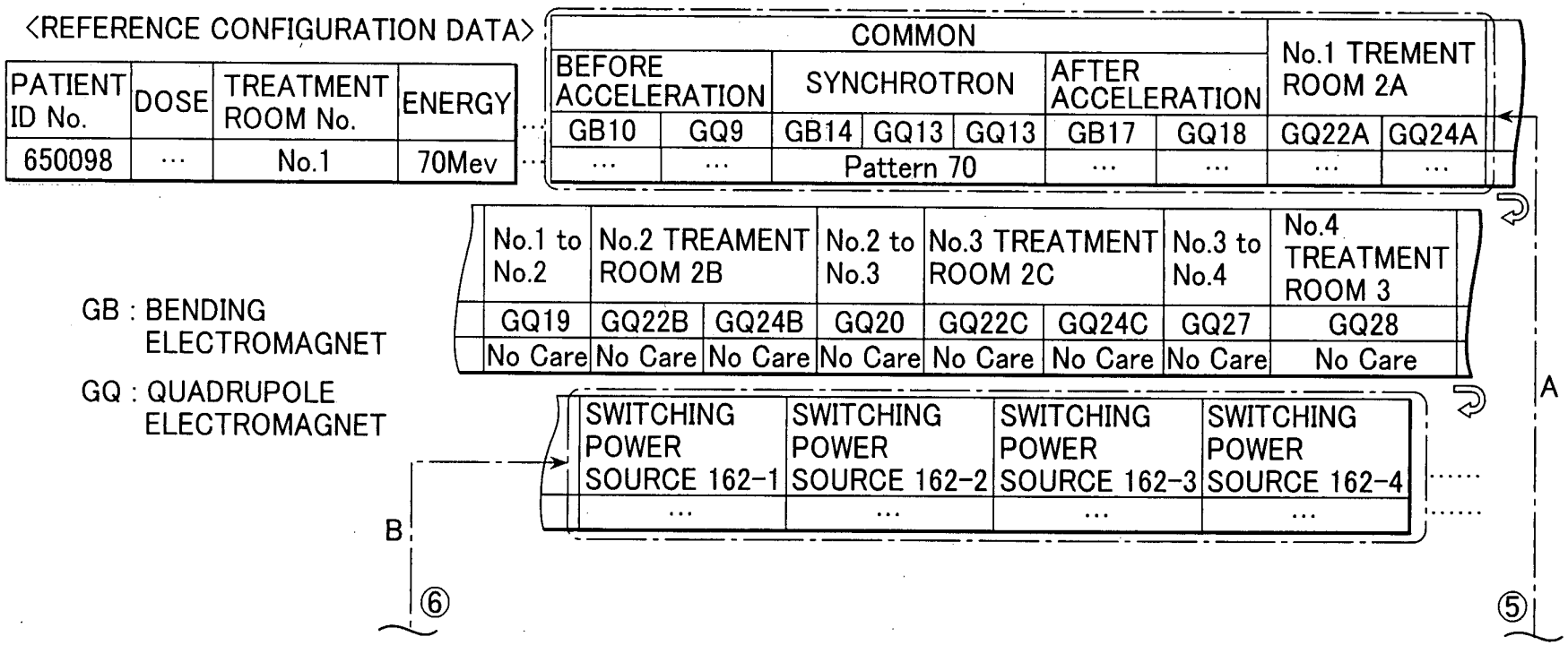

<REFERENCE CONFIGURATION DATA>
PATIENT ID No.
DOSE
TREATMENT ROOM No.
ENERGY
650098
…
No.1
70Mev
COMMON
BEFORE ACCELERATION
SYNCHROTRON
AFTER ACCELERATION
No.1 TREMENT ROOM 2A
GB10
GQ9
GB14
GQ13
GQ13
GB17
GQ18
GQ22A
GQ24A
Pattern 70
No.1 to No.2
No.2 TREAMENT ROOM 2B
No.2 to No.3
No.3 TREATMENT ROOM 2C
No.3 to No.4
No.4 TREATMENT ROOM 3
GQ19
GQ22B
GQ24B
GQ20
GQ22C
GQ24C
GQ27
GQ28
No Care
GB : BENDING ELECTROMAGNET
GQ : QUADRUPOLE ELECTROMAGNET
SWITCHING POWER SOURCE 162-1
SWITCHING POWER SOURCE 162-2
SWITCHING POWER SOURCE 162-3
SWITCHING POWER SOURCE 162-4
A
B
⑤
⑥

FIG.14

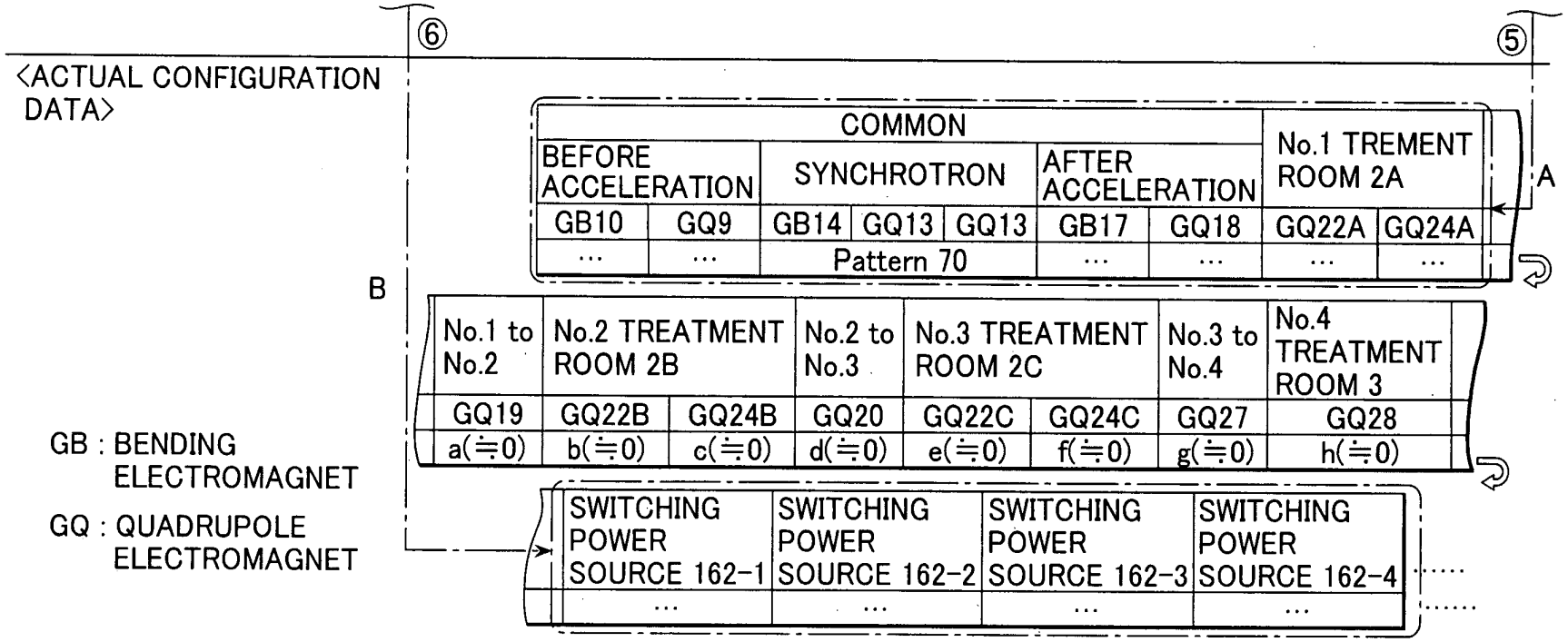

<ACTUAL CONFIGURATION DATA>
⑥
⑤
A
B
COMMON
BEFORE ACCELERATION
SYNCHROTRON
AFTER ACCELERATION
No.1 TREMENT ROOM 2A
GB10
GQ9
GB14
GQ13
GQ13
GB17
GQ18
GQ22A
GQ24A
…
…
Pattern 70
No.1 to No.2
No.2 TREATMENT ROOM 2B
No.2 to No.3
No.3 TREATMENT ROOM 2C
No.3 to No.4
No.4 TREATMENT ROOM 3
GQ19
GQ22B
GQ24B
GQ20
GQ22C
GQ24C
GQ27
GQ28
a(≒0)
b(≒0)
c(≒0)
d(≒0)
e(≒0)
f(≒0)
g(≒0)
h(≒0)
SWITCHING POWER SOURCE 162-1
SWITCHING POWER SOURCE 162-2
SWITCHING POWER SOURCE 162-3
SWITCHING POWER SOURCE 162-4
GB : BENDING ELECTROMAGNET
GQ : QUADRUPOLE ELECTROMAGNET

FIG.15

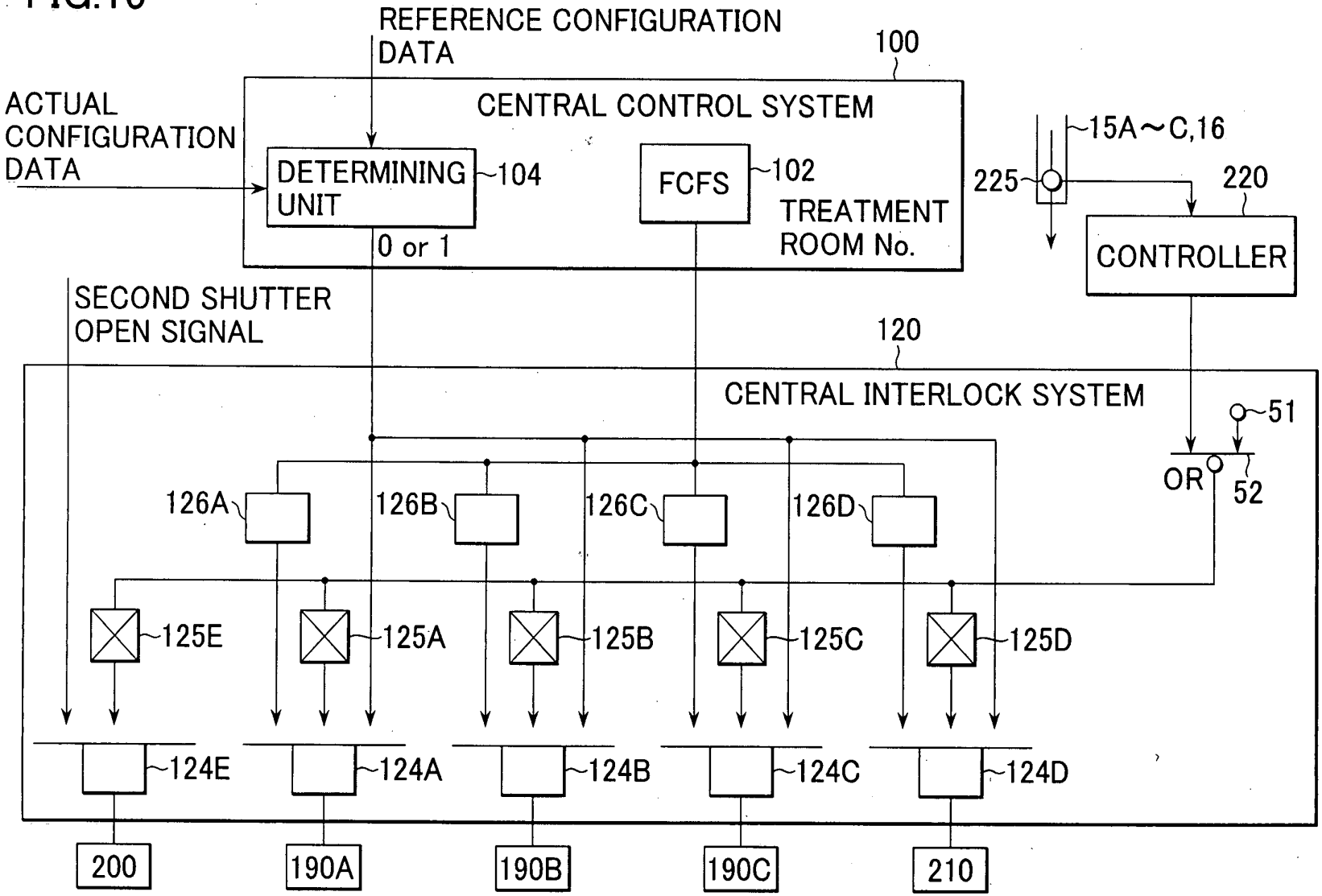

REFERENCE CONFIGURATION DATA
100
ACTUAL CONFIGURATION DATA
CENTRAL CONTROL SYSTEM
DETERMINING UNIT
104
FCFS
102
TREATMENT ROOM No.
0 or 1
15A～C,16
225
220
CONTROLLER
SECOND SHUTTER OPEN SIGNAL
120
CENTRAL INTERLOCK SYSTEM
51
OR
52
126A
126B
126C
126D
125E
125A
125B
125C
125D
124E
124A
124B
124C
124D
200
190A
190B
190C
210

FIG.16

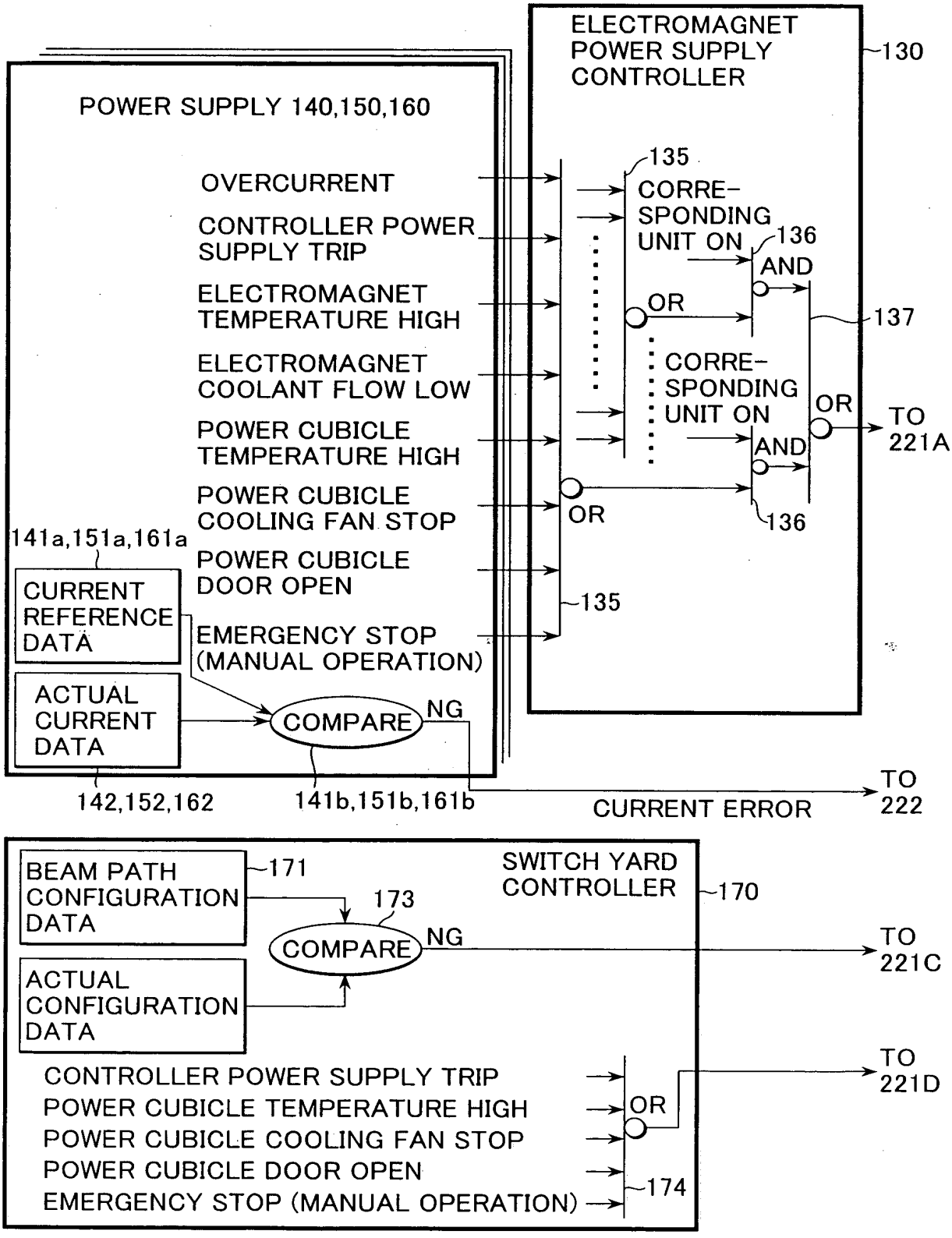

ELECTROMAGNET POWER SUPPLY CONTROLLER
130
POWER SUPPLY 140,150,160
135
OVERCURRENT
CONTROLLER POWER SUPPLY TRIP
ELECTROMAGNET TEMPERATURE HIGH
ELECTROMAGNET COOLANT FLOW LOW
POWER CUBICLE TEMPERATURE HIGH
POWER CUBICLE COOLING FAN STOP
POWER CUBICLE DOOR OPEN
EMERGENCY STOP (MANUAL OPERATION)
CORRE-SPONDING UNIT ON
136
AND
OR
137
CORRE-SPONDING UNIT ON
OR
TO 221A
AND
OR
136
135
141a,151a,161a
CURRENT REFERENCE DATA
ACTUAL CURRENT DATA
COMPARE
NG
142,152,162
141b,151b,161b
CURRENT ERROR
TO 222
BEAM PATH CONFIGURATION DATA
171
SWITCH YARD CONTROLLER
170
173
COMPARE
NG
TO 221C
ACTUAL CONFIGURATION DATA
CONTROLLER POWER SUPPLY TRIP
POWER CUBICLE TEMPERATURE HIGH
POWER CUBICLE COOLING FAN STOP
POWER CUBICLE DOOR OPEN
EMERGENCY STOP (MANUAL OPERATION)
OR
TO 221D
174

FIG.17

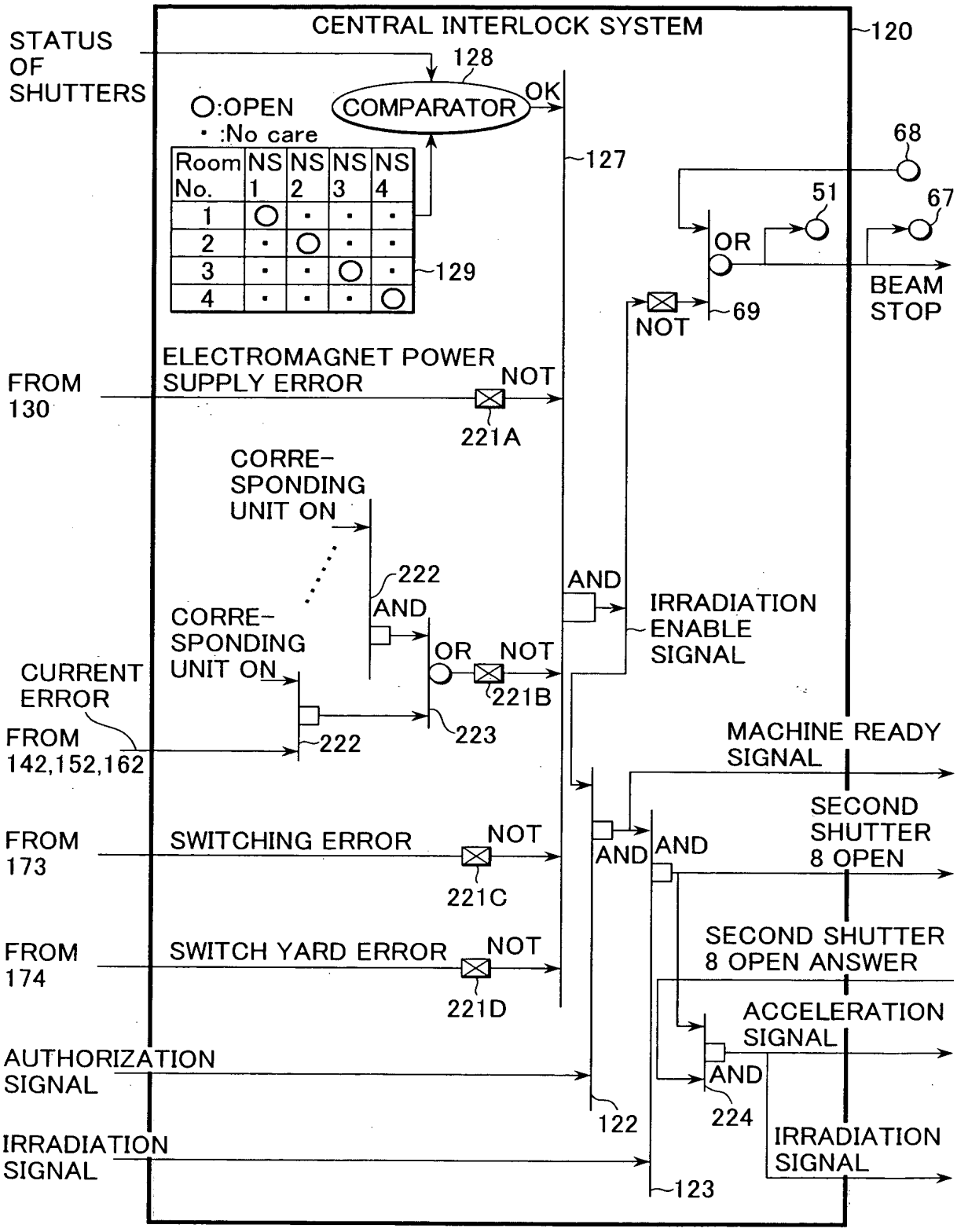

CENTRAL INTERLOCK SYSTEM
120
STATUS OF SHUTTERS
128
COMPARATOR
OK
O:OPEN
• :No care
Room No.
NS 1
NS 2
NS 3
NS 4
1
2
3
4
129
127
68
51
67
OR
BEAM STOP
NOT
69
FROM 130
ELECTROMAGNET POWER SUPPLY ERROR
NOT
221A
CORRE-SPONDING UNIT ON
222
AND
IRRADIATION ENABLE SIGNAL
CORRE-SPONDING UNIT ON
OR
NOT
221B
CURRENT ERROR
FROM 142,152,162
222
223
MACHINE READY SIGNAL
FROM 173
SWITCHING ERROR
NOT
221C
AND
AND
SECOND SHUTTER 8 OPEN
FROM 174
SWITCH YARD ERROR
NOT
221D
SECOND SHUTTER 8 OPEN ANSWER
ACCELERATION SIGNAL
AUTHORIZATION SIGNAL
AND
224
122
IRRADIATION SIGNAL
IRRADIATION SIGNAL
123

FIG.18

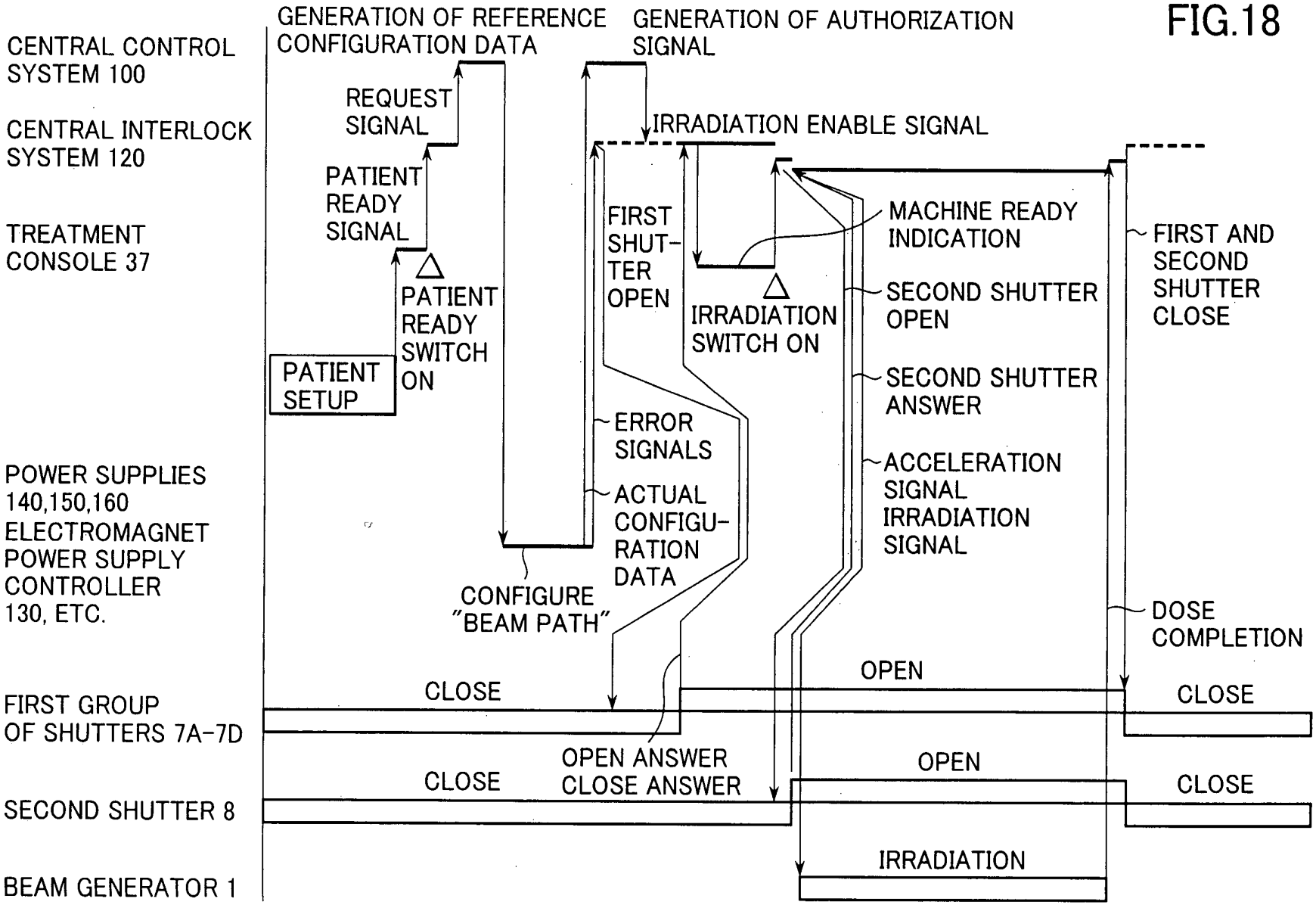

CENTRAL CONTROL SYSTEM 100
CENTRAL INTERLOCK SYSTEM 120
TREATMENT CONSOLE 37
POWER SUPPLIES 140,150,160 ELECTROMAGNET POWER SUPPLY CONTROLLER 130, ETC.
FIRST GROUP OF SHUTTERS 7A-7D
SECOND SHUTTER 8
BEAM GENERATOR 1
GENERATION OF REFERENCE CONFIGURATION DATA
GENERATION OF AUTHORIZATION SIGNAL
REQUEST SIGNAL
IRRADIATION ENABLE SIGNAL
PATIENT READY SIGNAL
FIRST SHUTTER OPEN
MACHINE READY INDICATION
FIRST AND SECOND SHUTTER CLOSE
PATIENT READY SWITCH ON
IRRADIATION SWITCH ON
SECOND SHUTTER OPEN
PATIENT SETUP
SECOND SHUTTER ANSWER
ERROR SIGNALS
ACCELERATION SIGNAL IRRADIATION SIGNAL
ACTUAL CONFIGURATION DATA
CONFIGURE "BEAM PATH"
DOSE COMPLETION
OPEN
CLOSE
CLOSE
OPEN ANSWER CLOSE ANSWER
OPEN
CLOSE
IRRADIATION

FIG.19

GB : BENDING ELECTROMAGNET